



FRASS

INSECT REARING NEWSLETTER

January 1975

Scientists involved in insect rearing programs recognize the need for cooperative endeavor directed at the solution of common problems. In an effort to foster communication and provide a vehicle for such cooperation, this national newsletter has been established. It is intended to facilitate interaction among rearing personnel and promote efficiency in our respective research programs. Newsletters will be distributed at least semiannually, however frequency will vary according to the volume of contributions. This service is available to all organizations (federal, state, private) and disciplines (biological control, research support etc.), depending on your personal assessment of the newsletter's usefulness. Those included on the initial mailing list invite you to participate.

Considerable interest has been expressed concerning the need for a directory of rearing personnel and identification of our common problems. Subjects of mutual concern include:

1. Acquisition of inexpensive, quality supplies.
2. Foster cooperative research and publication.
3. Locate sources of useful insect species.
4. Define requirements for rearing facilities.
5. Standardization of diets, techniques, and facilities.
6. Establishment of standards for measuring insect quality.
7. Develop systems analysis for insect rearing.
8. Access to engineering expertise.
9. Cooperate with insect geneticists.
10. Effective sanitation and quarantine procedures.
11. Exchange pertinent literature.
12. Support for insect rearing as a scientific endeavor.

Categories of information include:

1. Directory of rearing personnel.
2. Sources of technical information.
3. Problems encountered.
4. Resources needed.
5. Resources available.
6. News - meetings, awards, moves, employment opportunities.
7. Literature

Your specific needs within the context of this format, interest in participating (including a commitment of time and resources), and any other pertinent information should be communicated to a designated coordinator from your region. Entries will include only terse descriptions and sources of more precise data. Remember, cooperation is essential for accomplishing these objectives, and FRASS is behind every successful insect rearing program!

Current Coordinators: Southern Region - N. C. Leppla, J. R. Raulston, and
F. D. Brewer
Western Region - M. A. Patterson, R. Patana, and
J. L. Roberson
North Central Region - W. A. Dickerson
Northeastern Region - T. M. O'Dell

Entries:

N. C. Leppla, Gainesville - Primary objectives for our insect rearing newsletter during 1975 are to: 1- compile an index of active participants and their colonized species; 2- circulate a source list for rearing materials; and 3- expedite communication within the "insect rearing community." So, please spread the word!

W. A. Dickerson, Columbia - Subsequent newsletters will be sent only in YOUR SUBMITTED, SELF ADDRESSED AND FRANKED ENVELOPE. This should be sent to one of your regional representatives as soon as possible. Be sure to include a list of the species you rear and the information you wish to communicate in the next issue.

T. R. Ashley and N. C. Leppla, Gainesville - We are compiling a USDA TECHNICAL BULLETIN that will become the first comprehensive reference on insect rearing facilities and equipment. It will include at least 3 sections: I. Mass Rearing and Holding Facilities, II. Custom Rearing Environments (i.e., research colonies), and III. Bioclimatic Cabinets. Subsections will be provided for precision systems, adequate facilities, and economy schemes. Authorship will be retained for each contribution (i.e., chapter style), and is open to all agencies (federal, state, private). Utility is being stressed, since this is a research tool; and your ideas and contributions are hereby solicited.

D. L. Chambers, Gainesville - A workshop on the "Genetics of Insect Behavior" was held in Gainesville on September 24-26, 1974. The overall objective was to conduct a review, discussion, and planning session on the question of genetic and behavioral deterioration and amelioration in mass produced insects. Topics and moderators included: I. Examples of deficiencies and improvements in essential behavioral traits in colonized insects - D. E. Weidhaas, II. Theoretical and practical bases for alterations in the performance of colonized insects - I. C. McDonald, III. Measuring the performance of colonized insects - D. L. Chambers, and IV. Preventing deterioration of ameliorating the performance of colonized insects - L. E. LaChance. A review of the discussions and development of plans for dealing with the problem have been organized by W. Klassen and the other moderators, as topic V.

W. A. Dickerson, Columbia and N. C. Leppla, Gainesville - Current sources and prices for insect rearing supplies:

<u>Item</u>	<u>Description</u>	<u>Source</u>	<u>Cost</u>
Agar	fine	Moorehead & Co. 14801 Oxnard St. Van Nuys, CA 91401 213-873-6640	\$8.45/lb
		Perny, Inc. P. O. Box 721 Ridgewood, N. J. 07451 201-845-4808	\$7.65/lb
Aureomycin	chlorotetracycline powder, 64 g/lb	Ozark Supply Co. American Cyanamid 1614 Wyoming Kansas City, Mo.	\$117.80/25 lb
Alphacel	non-nutritive, bulk	Nutritional Biochemicals, Inc. 26201 Miles Road Cleveland, OH 44128 216-662-0212	\$63.00/cwt
Ascorbic Acid		Roche Chemical Division Hoffman-LaRoche, Inc. Nutley, N. J. 07110 201-325-5000	\$1.85/lb
Calcium alginate	Kelgin HU	Kelco Co. 20 N. Wacker Dr. Chicago, IL 60606	\$132.00/cwt
Getcarinon	HWG	Marine Colloids, Inc. 2 Edison Place Springfield, N. J.	\$365.00/cwt
Casein	crude, 80 mesh	Milk Specialities P. O. Box 278 Dundee, IL 60118 312-426-3411	\$0.65/lb
CSM		Krause Milling Co. 4222 W. Burnham St. P. O. Box 1156 Milwaukee, WI 53215	\$0.15/lb
Formaldehyde	40%	Fisher Scientific	\$16.32/5 gal
KOH	45%	Fisher Scientific	\$33.52/5 gal
Linseed Oil	raw	GSA	\$18.40/5 gal

Methyl-p	Methyl-para hydroxybenzoate, technical	Tenneco Chemicals, Inc. 56 N. Elston Ave. Chicago, IL 60639 312-236-5333	\$65.50/25 lb
Pinto beans	whole	Bemhem & Co. % T. W. Holt, Inc. P. O. Box 2948 Jacksonville, FL 32203	\$34.20/cwt
Potassium Sorbate	Sorbistat K	Pfizer Corp. 6460 W. Courtland St. Chicago, IL 60635 c/o J. H. Dugger, Res. Mgr.	\$38.75/25 lb
Salt mix (W)	Wesson	Nutritional Biochemicals Co. Cleveland 216-622-0212	\$25.25/25 lb
Soy Protein	Supro 610	Ralston Purina Co. Checkerboard Square St. Louis, MO 63183	\$0.90/lb (min. 50 lb)
Tenox	PG	Eastman Chemical Products, Inc. Order Services Kingsport, TN 37662	\$6.07/5 lb
Vitamin Mix	# 15911D	Roche Chemical Div. Hoffman-LaRoche, Inc. Nutley, N. J. 07110 201-235-5000	\$1.50/lb
Wheat		H. V. Nootbaar Co. 890 S. Arroyo Parkway Pasadena, CA 91105	\$0.15/lb (2000 lb minimum)
Wheat germ	toasted, regular	Kretchmer Products International Multifoods Corp. 1200 Multifoods Bldg. Minneapolis, MN 55402 612-340-3471	\$45.00/150 lb
WSB		Krause Milling Co. 4222 W. Burnham St. P. O. Box 1156 Milwaukee, WI 53215	

Yeast - torula

St. Regis Paper Co.
Lake States Division
603 W. Davenport St.
Rhinelander, WI 54501

\$0.25/lb

Containers

Cups - plastic 1 oz.

Thunderbird Container
Corp.
P. O. Box 12033
El Paso, TX 79912
915-584-1151

\$32.50/5000
(case)

Lids - 1 oz paper (press in)
1.476" diam

Standard Cap & Seal
P. O. Box 80336
Chamblee, GA 30341

\$20.00/10,000

Tray 50 cell
#J-2

Trend Mfg. of America
1663 N. McDuff Ave.
P. O. Box 6915
Jacksonville, FL 32205

\$65.00/M

Mylar lidding for
50 cell tray

Sandoz-Wonder Corp.
18900 S. W. 280th St.
Homestead, FL 33030
% David Shible

\$127.00/r1
(4500 ft)

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Brownsville, TX 78520

J. E. Wright
Veterinary Toxicology Lab
P.O. Drawer GE
College Station, TX 77840

C. E. Yonce
SE Fruit & Tree Nut Lab
P.O. Box 87
Byron, GA 31008

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Coastal Plain Exp. Sta.
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WESTERN REGION

L. A. Andres
Biol. Control of Weeds Lab
1050 San Pablo Avenue
Albany, CA 94706

D. H. Akey
Denver Federal Center
P.O. Box 25327
Denver, CO 80225

A. C. Bartlett
Western Cotton Res. Lab
4135 E. Broadway Road
Phoenix, AZ 85040

C. C. Blickenstaff
Veg. & Sugarbeet Ins. Lab
P.O. Box 67
Twin Falls, ID 83301

J. G. Bowne
Building 41
Denver Federal Center
Denver, CO 80225

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2000 E. Allen Road
Tucson, AZ 85719

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2120 Camden Road
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Basic Biology Lab
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FRASS



INSECT REARING NEWSLETTER

July 1975

Your remarkable enthusiasm has made the production of FRASS a very worthwhile endeavor. In fact, R. M. Baranowski submitted that, "Some people just have a natural proclivity for this type of dissemination." I think this comment is a rather eloquent example of diarrhea of the pencil! Seriously, we have identified nearly 400 eager participants from three continents, circulated and updated a list of inexpensive quality insect rearing supplies, compiled an index of sources of cultured arthropods, and initiated cooperative research. A technical bulletin is being compiled on facilities for insect research and production, and a book will soon be published entitled *Insect Dietetics*. It has been a very productive and exciting year for the insect-rearing community.

We thank all of you for your support; most participants encouraged and contributed to this effort during the past year. FRASS is intended to serve the needs of active participants and, therefore, your work will be rewarded. W. A. Dickerson will compile the next two issues.

During the next 12 months, we need to increase the amount of communication among our colleagues, and continue to encourage other interested scientists to participate. More entries should be printed about useful discoveries, unusual problems encountered, needed resources, and news of general interest. The semiannual bibliography should be expanded considerably. Also, if we could document savings in time and materiel, it would help to justify the expense of this newsletter. Please feel free to submit your contributions and needs. FRASS is not just a lot of KRAPP!

T. R. Ashley and N. C. Leppla - Authorship is being finalized for the USDA Technical Bulletin, *Facilities for Insect Research and Production*, that we are editing. If you wish to be included please contact us within 90 days.

R. A. Byers - I am currently rearing the clover root curculio, *Sitona hispidula*, on alfalfa plants without soil. The technique is called the nutrient slantboard method (Kendall and Leath, 1974. *Crop. Sci.* 10:584-6). Survival from egg to pupa is about 50%.

T. L. Chapman - (Eastern Field Manager, Marine Colloids, Inc.) New prices for Gelcarin H WG (Feb. 14, 1975) are 1000 lbs plus in 200 lb drums, \$3.25/lb; less than 1000 lbs add \$0.25 per lb; less than 200 lbs add \$1.25 per lb; minimum order 50 lbs.

G. M. Chippendale - Wheat germ oil ("Rex" brand, cold processed) is manufactured by Vio Bin Corp., Monticello, Ill. and distributed by University Food Supplements, 2101 Hudson Street, Lynchburg, Va. 24505. Price (12/74) \$6.00/qt.

W. A. Dickerson - (1) I have some practical information on controlling pest insects within an insectory; especially Trichogramma and roaches. I will be glad to pass it along if you have a problem.

(2) Bacterial and fungal inhibitors are generally required in insect diets. Many different materials are available to control the contaminants; however, little is known about how they affect the feeding insects. If you have any information on a specific inhibitor or know of publications on the subject please inform me for the next issue of FRASS.

R. E. Dolphin - Thinning (immature) apples about 1-inch in diameter have been stored for 1-1/2 years and still maintain quality for rearing several species of fruit insects. The apples were late varieties that have been in cold storage since the day of harvest. Temperatures of 32-35°F are essential and the fruit are stored in plastic bags to minimize moisture loss, disease transmission and ethylene gas diffusion (a ripening agent).

R. L. Gallun - R.L. Gallun, J.E. Foster, and Omelio Sosa, Jr. Hessian Fly Laboratory, Agr. Res. Serv., USDA, and Department of Entomology, Purdue University, W. Lafayette, Indiana. Hessian fly populations are reared on susceptible wheat grown in soil in standard greenhouse flats. Individual progenies are reared on susceptible wheat in soil in 4" plastic pots. Eight races of Hessian fly differing in their ability to survive on and stunt wheats having different genes for resistance are maintained at the laboratory. These Hessian fly races (bio-types) are used to evaluate wheats for resistance, to determine what genes are present in unknown material, to distinguish between different genes for resistance, and to locate new genes for resistance. Pure line progenies are also maintained to study the genetics of virulence of race individuals and to study the nature of virulence. The Great Plains race is reared in great numbers for use in a release program to control field races by flooding native populations with a Hessian fly race that contains dominant genes for avirulence. Turkey and Blueboy varieties are susceptible to all races. Monon and Arthur are susceptible to Races B, D, E, and G, but resistant to Races GP, A, C, and F. Knox 62 and Benhur varieties are susceptible to Races C, D, F, and G but resistant to Races GP, A, B, and E. Arthur 71, Oasis, and Abe are resistant to all known races.

J. D. Griffith - I have recently ordered 100 lbs of agar and 25 lbs of ascorbic acid from suppliers listed in FRASS. I saved \$100 on the ascorbic acid. (\$4.22/lb vs. \$8.25/lb). On the agar purchase, I am unable to determine what we paid for the previous batch but in 1973 we paid \$10.00/lb. On this basis we saved \$155 (\$8.25/lb vs. \$10.00/lb). The two items saves us \$255 altogether. FRASS is well worth your trouble.

K. S. Hagen - (by telephone) Bee wheast (10% ash) is available for insect rearing and distributed by Stauffer Chemical Company, 712 N. Leslie Road, Visalia, California 93277 (\$0.40/lb at factory). Food wheast is not recommended for insect rearing.

E. G. King - Sources and prices for insect rearing supplies are useful and we have already saved ca. \$300 on agar.

N. C. Leppla - (1) We are currently rearing the cabbage looper, Trichoplusia ni; soybean looper, Pseudoplusia includens; corn earworm, Heliothis zea; beet armyworm, Spodoptera exigua; fall armyworm, S. frugiperda; and the Caribbean fruit fly, Anastrepha suspensa.

(2) I have 200 lbs of agar that I will gladly trade for an equal quantity of Gelcarin H WG (you pay the shipping).

R. F. Moore - Potassium sorbate can be obtained from Aceto Chemical Co., 3120 College Point Boulevard, Flushing, N. Y. 11354. (\$2.75/lb in small quantities).

D. G. Nielsen - At this time we are trying to develop laboratory techniques for rearing the lilac borer, Podosesia syringae, on a meridic diet. We are also interested (unsuccessfully, I'm afraid) in rearing black vine weevil, Otiorhynchus sulcatus in the laboratory. Any ideas?

M. A. Petterson - (1) The last national rearing conference was held in 1963 and entitled "Insect, Nutrition and Rearing Conference." The subsequent proliferation of research on this subject warrants another at least regional workshop. Production aspects have been particularly neglected, and some of our basic objectives should be reevaluated. I am interested in organizing such a meeting and would appreciate your opinion and support.

(2) We cut costs on casein, ascorbic acid and formaldehyde by using the sources listed in FRASS.

(3) The following may be added to the current sources list:

<u>Item</u>	<u>Description</u>	<u>Source</u>	<u>Price</u>
Viva paper towels	Blue. Specify blue <u>only</u>	Scott Paper Co Bob Shell, Production manager Scott Plaza Philadelphia, PA 19113	\$14.77/case (10 cases minimum)
Cell-Pac, (CP-25)	Autoclavable holders for Thunderbird 1-oz cups	Diamond National P. O. Box 697 Phoenix, AZ 85001	\$9.64/case (400 pks/case)
Cold Meat Storage Trays #4470	Plastic rearing trays. 9-1/4 x 9-1/4 x 2-1/2"	<u>West Coast:</u> Cal. Sales, 1738 S. El Mar San Gabriel, CA 91776 Bob Pastor 213-283-0719 <u>East Coast:</u> Eagle Affiliates Brooklyn, NY 903-649-8007	\$8.05/case of 12

Alfalfa Meal	Fine ground	Nutralite Products	\$.45/lb in
		P.O. Box 98	200 lb lots.
		Lakeview, CA 92353	
Choline Chloride	Crystals	ICN Pharmaceuticals*	\$.0115/gm
		26201 Miles Road	
		Cleveland, OH 44128	
Hexcell	Expanded resin-coated honeycomb HRH-10	Hexcell Corp	\$1.00/lb
		6151 W. Century Blvd	
		Suite 1114	
		Los Angeles, CA 90045	
		Phone 213-776-8740	

* Formerly NBC

P. Singh - (1) The Insect Rearing Section was established (1974) within Entomology Division at Mount Albert Research Centre, Department of Scientific and Industrial Research, Private Bag, Auckland, New Zealand. I am the Section Leader. The main functions of the Section are to do research, service, and advisory work. RESEARCH ACTIVITY: Development of artificial diets and mass-production for economically important insects; development of new methods and improvements of existing methods for rearing insects; development of methods for shipping and transporting insects; studies on basic nutritional physiology; nutritional diseases, gnotoentomology and symbionts with microorganisms; role of antimicrobial food additives, antibiotics and antimetabolite in insect diets; and hormonal physiology. SERVICE: The section will work as a central unit to provide experimental insects in all phases of research and also maintains laboratory colonies. ADVISORY ROLE: The section also helps and advises other Government Departments, the Ministry of Agriculture and Fisheries, universities, colleges, commercial firms and individuals on problems of insect rearing and colonization.

(2) LABORATORY COLONIES OF INSECTS IN NEW ZEALAND: On the invitation of Entomological Society of New Zealand, I am compiling a list of laboratory colonies of insects in New Zealand. The list will be published by the Society by the end of 1975.

(3) INSECT DIETETICS: Manuscript is under preparation. The possible publishing date is end of 1976 or early 1977.

(4) ARTIFICIAL DIETS FOR INSECTS: A compilation of references with abstracts (1970-72) composing 96 pages. It is a continuation of two earlier bulletins by House (1967) and House, Singh, and Batsch (1971) (Information Bulletins 5 & 7, Canada Dept. Agric.). Bulletin 214 is available from the Publications Officer, Information Service DSIR, Private Bag, Wellington, New Zealand (\$3.00 to Dept of Sci. & Indus. Res.).

M. W. Stone - The following article may be helpful: M. W. Stone, 1935. Techniques for life-history studies of wireworms. J.Econ.Entomol. 28:817.

Recently Published Articles

- Antonio, A. Q., J. R. McLaughlin, N. C. Leppla, and C. W. Green. 1975. Culturing the lesser peachtree borer. J. Econ. Entomol. (In Galley).
- Leppla, N. C., and P. V. Vail. 1975. Status of mass rearing and handling techniques for the cabbage looper. In G.L. Greene (ed.) State of Knowledge of the Cabbage Looper, 1973. Univ. of Fla. Press.
- Singh, Pritam. 1974. Aseptic rearing of the light brown apple moth, Epiphyas postvittana (Walker) (Lepidoptera:Tortricidae), on a meridic diet. N. Z. J. Zool. 1(1):111-7.
- Singh, Pritam. 1974. A chemically defined medium for rearing Epiphyas postvittana (Lepidoptera:Tortricidae). N. Z. J. Zool. 1(2):241-3.
- Singh, Pritam. 1974. Artificial diet for insects: A compilation of references with abstracts (1970-72). DSIR Bul. No. 214, 96 pp. (ISSN 0077-96IX)
- Singh, Pritam and R. J. B. Power 1975. Laboratory rearing method for the stem weevil, Hyperodes bonariensis (Coleoptera:Curculionidae). N. Z. J. Zool. 1(4):531-6.
- Thomas, H. A. 1971. Development of pales weevil larvae on an emulsified synthetic diet. USDA, USFS Research Note SE-163, 3 p.

ARTHROPOD CULTURES

<u>Species</u>	<u>Location</u>
Acarina	
<i>Amblyomma americanum</i>	8
<i>Amblyomma cajennense</i>	8
<i>Amblyomma inornatum</i>	8
<i>Amblyomma maculatum</i>	8
<i>Anocentor nitens</i>	8
<i>Argas radiatus</i>	8
<i>Boophilus annulatus</i>	8
<i>Boophilus microplus</i>	8
<i>Dermacentor albipictus</i>	8
<i>Dermacentor andersoni</i>	8
<i>Dermacentor variabilis</i>	8
<i>Panonychus citri</i>	13
<i>Rhipicephalus sanguineus</i>	8
<i>Tetranychus cinnabarinus</i>	5
<i>Tetranychus urticae</i>	18, 19, 5
Coleoptera	
<i>Agrilus bilineatus</i>	16
<i>Ahasverus advena</i>	28
<i>Anthrenus flavipes</i>	28 ⁵
<i>Anthonomus grandis</i>	10
<i>Araecerus fasciculatus</i>	28
<i>Attagenus megatoma</i>	28
<i>Coccinella 7-punctata</i>	7
<i>Conotrachelus nenuphar</i>	18
<i>Conotrachelus nenuphar</i> (malathion resist)	24
<i>Cryptolestes pusillus</i>	19, 24
<i>Cyanaeus angustus</i>	28
<i>Diabrotica balteata</i>	6
<i>Diabrotica undecimpunctata howardi</i>	19
<i>Diabrotica u. undecimpunctata</i>	18
<i>Epilachma varivestis</i>	5, 15, 19
<i>Gibbium psylloides</i>	28
<i>Gnathocerus cornutus</i>	30
<i>Gnathocerus maxillosus</i>	28
<i>Hypera brunneipennis</i>	18
<i>Lasioderma serricorne</i>	28
<i>Latheticus oryzae</i>	28
<i>Leptinotarsa decemlineata</i>	5
<i>Leptinotarsa defecta</i>	18
<i>Lyctus planicollis</i>	16
<i>Necrobia rufipes</i>	28
<i>Oryzaephilus mercator</i>	28
<i>Oryzaephilus surinamensis</i>	18, 28
<i>Palorus ratzeburgi</i>	28

<u>Species</u>	<u>Location</u>
Coleoptera (continued)	
<i>Ptilinus pectinicornis</i>	16
<i>Rhyzopertha dominica</i>	28
<i>Scolytus multistriatus</i>	16
<i>Sitona hispidula</i>	4
<i>Sitophilus granarius</i>	19, 28, 30
<i>Sitophilus oryzae</i>	30, 28
<i>Sitophilus zeamais</i>	28
<i>Stegobium paniceum</i>	30
<i>Tenebrio molitor</i>	12, 18, 16, 19, 30
<i>Tenebrio obscurus</i>	28
<i>Tenebroides mauritanicus</i>	28
<i>Tribolium audax</i>	28
<i>Tribolium castaneum</i>	12, 18, 28, 30
<i>Tribolium castaneum (malathion resist)</i>	28
<i>Tribolium confusum</i>	12, 18, 19, 28, 30
<i>Tribolium madens</i>	28
<i>Trogoderma inclusum</i>	28
<i>Typhaea stercorea</i>	28
Diptera	
<i>Aedes aegypti</i>	18, 19
<i>Aedes sierrensis</i>	14
<i>Aedes triseriatus</i>	14
<i>Archytas marmoratus</i>	3
<i>Culex pipiens pipiens</i>	14
<i>Culex pipiens quinquefasciatus</i>	14
<i>Culex tarsalis</i>	14
<i>Cuterebra fontinella</i>	8
<i>Drosophila melanogaster</i>	5
<i>Eucelatoria sp.</i>	3
<i>Fannia canicularis</i>	14
<i>Phytophaga destructor</i>	23
<i>Rhagoletis pomonella</i>	24
<i>Haematobia irritans</i>	8
<i>Lixophaga diatraeze</i>	9
<i>Musca domestica</i>	2, 14, 18, 16, 19, 30
<i>Muscina stabulans</i>	14
<i>Palexorista laxa</i>	3
<i>Stomoxys calcitrans</i>	8, 14
<i>Tetanops myopaeformis</i>	1
Hemiptera	
<i>Acrosternum hilare</i>	15
<i>Acrosternum marginatum</i>	15
<i>Acyrtosiphon pisum</i>	19
<i>Aonidiella aurantii</i>	13
<i>Aphis gossypii</i>	18

<u>Species</u>	<u>Location</u>
Hemiptera (continued)	
<i>Coranus</i> sp.	3
<i>Euchistus obscurus</i>	15
<i>Euchistus servus</i>	15
<i>Geocoris punctipes</i>	25
<i>Lygus hesperus</i>	18
<i>Nezara viridula</i>	15
<i>Oncopeltus fasciatus</i>	12, 19, 16
Homoptera	
<i>Planococcus citri</i>	13
<i>Trialeurodes vaporariorum</i>	5
Hymenoptera	
<i>Anaphes flavipes</i>	7
<i>Apanteles marginiventris</i>	25
<i>Apanteles melanoscelus</i>	16
<i>Aphelinus</i> sp.	7
<i>Bathyplectes arurus</i>	7
<i>Bathyplectes curculionis</i>	7
<i>Bracon gelechiae</i>	3
<i>Bracon greeni</i>	3
<i>Bracon kirkpatricki</i>	3
<i>Campolitis sonorensis</i>	17
<i>Campolitis flavicincta</i>	27
<i>Cardiochiles nigriceps</i>	17
<i>Chelonus blackburni</i>	3
<i>Chelonus texanus</i>	17
<i>Diglyphus</i> spp.	7
<i>Euplictrus plathypinae</i>	27
<i>Euplictrus</i> spp.	27
<i>Hadrobregmus carinatus</i>	16
<i>Hypostes exiguae</i>	27
<i>Meteorus laphygmae</i>	27
<i>Microctonus aethiops</i>	7
<i>Microplitis croceipes</i>	17, 3, 9
<i>Parasierola emigrata</i>	3
<i>Pediobius foveolatus</i>	15
<i>Platybregmus canadensis</i>	16
<i>Pnigalio</i> spp.	7
<i>Pteromalus puparum</i>	26
<i>Trissolcus basalis</i>	15
<i>Uplecterous hircinis</i>	17
<i>Xylocopa virginica</i>	16

<u>Species</u>	<u>Location</u>
Lepidoptera	
<i>Agrotis ipsilon</i>	27, 27
<i>Anagosta kuehniella</i>	28
<i>Anticarsia gemmatilis</i>	29
<i>Argyrotaenia velutinana</i>	24
<i>Cadra cautella</i>	28
<i>Corpocapra pomonella</i>	24
<i>Diatraea grandiosella</i>	22
<i>Diatraea saccharalis</i>	9
<i>Estigmene acrea</i>	3, 18
<i>Epiphyas postvittana</i>	30
<i>Galleria mellonella</i>	30, 9
<i>Gnorimoschema operculella</i>	30
<i>Grapholitha molesta</i>	24
<i>Heliothis virescens</i>	3, 17, 18, 9, 29,
<i>Heliothis zea</i>	3, 11, 17, 18, 9, 29, 31, 6
<i>Laspeyresia pomonella</i>	30
<i>Liriomyza sativae</i>	5
<i>Liriomyza spp.</i>	5
<i>Loxagrotis albicosta</i>	7
<i>Pectinophora gossypiella</i>	3
<i>Pieris rapae</i>	29
<i>Platynota stultana</i>	5
<i>Plodia interpunctella</i>	28
<i>Plodia interpunctella (malathion resist)</i>	28
<i>Podosesia syringae syringae</i>	20
<i>Porthetria dispar</i>	16, 7
<i>Pseudoplusia includens</i>	29, 31
<i>Sanninoidae exitiosa</i>	20
<i>Sitotroga cerealella</i>	28
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<i>Spodoptera exigua</i>	3, 29, 31, 6
<i>Spodoptera frugiperda</i>	11, 12, 31
<i>Synanthedon pictipes</i>	24
<i>Trichoplusia ni</i>	3, 29, 18, 27, 31
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<i>Acheta domesticus</i>	19
<i>Blaberus craniifer</i>	2
<i>Blaberus discoidalis</i>	16, 2,
<i>Blaberus giganteus</i>	19
<i>Blattella germanica</i>	2, 16, 18, 19
<i>Blatta orientalis</i>	2, 19
<i>Byrsotria fumigata</i>	2
<i>Diploptera punctata</i>	2
<i>Eurycotis floridana</i>	2
<i>Grampadorhina portentosa</i>	16, 19, 2
<i>Leucophaea maderae</i>	2

<u>Species</u>	<u>Location</u>
Orthoptera (Continued)	
<i>Nauphoeta cinerea</i>	2
<i>Parcoblatta</i> spp.	2
<i>Periplaneta americana</i>	16, 18, 19
<i>Periplaneta brunnea</i>	2
<i>Supella longipalpa</i>	2
<i>Symploce capitata</i>	2
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<i>Bovicola bovis</i>	8
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Additional Resources:

Colonies of insects, mites, ticks, and spiders maintained in the USDA/ARS. Revised 1970 by Pesticide Chemicals Research Branch (Information: J. H. Fales, Bldg EA-C, Agr. Res. Center, Beltsville; R. E. Redfern, Environ. Qual. Inst., Agr. Res. Center, Beltsville, MD 20705) 291 species listed.

Additional Resources (Continued)

Entomophagous species under culture December, 1972. Int. Org. Biol. Cont. by J. S. Kelleher, Res. Prog. Serv. Sec., Can. Agr., K. W. Neatby, Bldg. Ottawa, Ontario, Can. K1A DC6. 164 species listed.

List of insecticide resistant strains under laboratory culture. WHO Publication, UBC/IRG/71.15. Supplement B revised July, 1971. 24 species listed.

Laboratory colonies of mites, ticks, and insects in Canada. 1971. Bul. Entomological Soc. Canada Vol. 3, No. 2. 220 species listed.

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